OHLMACHER (A.P.)

On the Importance of Technical Instruction in our Medical College Laboratories.

BY

A. P. OHLMACHER, M. D.,
CLEVELAND, OHIO,
Professor of Pathology and Bacteriology, Medical Department, University of Wooster.

REPRINTED FROM THE
New York Medical Journal
for March 21, 1896.

Reprinted from the New York Medical Journal
for March 21, 1896.

ON THE IMPORTANCE OF TECHNICAL INSTRUCTION IN OUR MEDICAL COLLEGE LABORATORIES.*

By A. P. OHLMACHER, M. D.,
CLEVELAND, OHIO,
PROFESSOR OF PATHOLOGY AND BACTERIOLOGY,
MEDICAL DEPARTMENT, UNIVERSITY OF WOOSTER.

The laboratory may be compared to an ideal workshop. Its equipment furnishes the tools, its students are the workmen, and the teacher becomes the foreman. A workshop is useless without tools—a laboratory is useless without equipment. A workshop with but a single set of tools for a number of workmen would not be regarded as an economical institution, and similarly a laboratory without equipment for its individual workers does not afford the best facilities for work. In a model workshop each workman has a workbench furnished with all the tools necessary for the performance of a given piece of work. In a model laboratory each student should have a separate desk and equipment for his individual use. Specialization in many of the industrial occupations has arrived at a stage

* Prepared for the special committee meeting of the Association of American Medical Colleges held in Chicago, February 15, 17, and 18, 1896.

in which a workman often employs his whole time on a certain kind of work; but the best workman in a special line is he whose general manual training has been broadest. The same tendency to specialization is seen in laboratory work, and here the most successful specialist is the one whose preliminary training has been broadest.

The foundation of a skillful workman's education lies in his manual training. He must be an expert in the use of the tools of his trade, be these the hands Nature has given him or the hands provided by man's ingenuity. His education begins tools in hand and progresses as practice makes him proficient in the use of these implements. He can not learn his trade from treatises upon it, nor from lectures upon it, nor from watching the work of other workmen. Individual manual practice must come first; then the treatise, the lecture, and the demonstration become useful. The moral, as applied to the laboratory student, is self-evident.

It may now be interesting to inquire how far the methods of the workshop have found their way into laboratory education as offered by our medical schools.

The principal instrument of the modern medical laboratory is the microscope. It is to the laboratory worker what the lathe is to the machinist, or the clay to the sculptor, or the piano to the pianist. In itself it is a pretty toy, of little more value than the formless clay in the hands of an untrained workman. It becomes a thing of life and of great practical utility only when its possessor has been educated in its use. A physician's proficiency in the use of the microscope may then be taken as an index of his laboratory training. Measured by this standard we find the results disappointing.

The majority of physicians in the United States who possess microscopes are unable to satisfactorily employ them

even in their routine daily work. Inquiry will reveal the fact that this difficulty is almost entirely due to lack of familiarity with the methods of microscopic laboratory work. This is certainly suggestive in its reflection upon the educational methods practised in medical-college laboratories, and especially so since it will be found that many young and enthusiastic men, recently graduated in medicine, are included in this category.

Of the various studies presented by the laboratory method in our American medical schools at present, chemistry certainly takes precedence in the perfection of its instruction. This is largely due, no doubt, to the greater length of time that this subject has occupied the attention of teachers. In laboratory chemistry the workshop idea has long been a prominent feature. To some extent, also, this applies to practical human anatomy as it has been taught for many years. In both of these studies the student is supplied with worktable, tools, and material for the work which he individually prosecutes.

In the more recently introduced medical laboratory studies, like histology, physiology, bacteriology, and pathology, all grades of variation from the ideal pedagogical method are to be found, and as these subjects are comparatively new in the curriculum of the medical college, and since the opinions of teachers differ widely as to the best methods of presenting them, my further discussion will be confined to them.

The true educational object of the medical school is to prepare its students to become independent, self-reliant practitioners of the medical and surgical art. The object of its laboratory instruction ought to be to prepare its students for independent work in the branches of knowledge taught therein. This object is only partially accomplished, at best, in histology, physiology, bacteriology, and pathol-

ogy as they are now taught in most medical schools, and I believe the fault lies largely in lack of technical training. In most institutions in which laboratory study in these branches is prosecuted, the preparatory technical work is done for the student by his teacher or by an assistant, and this practice I regard as the fatal stumbling-block in the way of good laboratory instruction. The student receives the more or less completely finished product of another's handiwork, and he fails to gain a practical individual familiarity with laboratory methods. He often carries away with him a number of specimens of some one else's laboratory work, and sometimes also he goes so far as to make a set of drawings in normal and pathological histology. He is about as well prepared for independent work as the cook's apprentice would be who attempted to learn the art of cooking from eating his master's products at the dining-room table. This, the "ready-cooked" method of laboratory teaching, prevails to a large extent in every medical college in this country, and, like some other bad things, has its origin in continental Europe, where poorly fed and underpaid *Dieners* do the technical drudgery for the classes of students. The day may come when the practical portion of laboratory studies will all be done by specialists; but this day, like the one in which the surgical diagnostician will be independent of the specialist who does the drudgery of cutting, has not yet dawned upon us.

I believed that the student in histology, for example, will have a clearer conception of the subject, and will be better fitted for actual work, after carrying out all the steps in the preparation of even rough sections of the organs of a freshly killed frog than if he studied many beautiful sections of tissue from various animals prepared for him by his teacher. And in pathology the working up of the raw material from one necropsy is of more ultimate benefit to

the student than an examination of dozens of ready-pre pared pretty sections illustrating various lesions in pathological histology. In bacteriology also, the very essence of independent work lies in a working familiarity with laboratory methods. Such illustrative specimens as microscopic sections have their place in laboratory teaching, it is true; but their place is only a step higher than the illustrations and descriptions in text books. In themselves they form a very poor basis for the students' future practical work, and it is a matter of regret to find so many laboratory teachers exclusively employing such incomplete, partial methods in their teaching. Drawing is also a fundamental method of object teaching and has its legitimate place in laboratory instruction along with laboratory notes. Illustrative specimens, notes, and drawings can not, however, make a well-rounded laboratory course without manual practice. Combine the three — technical training, written and graphic record, and illustrative specimens—and we have the means for presenting an ideal laboratory course.

A partially successful attempt to carry out the foregoing ideas in laboratory teaching in the medical school has given me some useful data. It will be impossible to enter into details at this time, though the very keynote of success often lies in a mastery of apparently insignificant details. I shall therefore direct your attention to some general aspects of the subject.

In carrying the workshop methods into the teaching of such subjects as histology, physiology, pathology, and bacteriology, the furniture and equipment of the laboratories deserve first attention. As far as possible each student should be supplied with the material which will make for him a miniature working laboratory. This means, of course, an individual desk, and an outfit of instruments and reagents stored in a suitable locker. The student's

working outfit should be of the simplest possible kind, both for economical reasons and because of the lesson it impresses that a great part of the routine laboratory work can be done with simple and inexpensive apparatus. Here the ingenuity of the teacher comes into play, and it should be the object of the laboratory worker, like the surgeon, to do the greatest possible amount of work with the fewest possible instruments. By this I do not mean that crude methods of work should be taught, for I believe thoroughly in encouraging the student to master the refinements of laboratory technique; but even the best methods can be carried out with simple tools.

The furnishing of several laboratories of this character will demand a considerable outlay of money at the outset, but it must be remembered that the college is not equipping one laboratory, but twenty-five laboratories, or fifty laboratories, depending on the size of the class of students to be accommodated. However, by careful attention to businesslike methods in supplying material to the students, a laboratory can be made self-sustaining. The student will not be expected to pay for the laboratory furniture of a stationary character, but he may be expected to pay for the supplies of material furnished to him.

As an example of the workings of a system of this kind I may point to the experience of the school which I represent, which expended three thousand dollars last year for the initial equipment of students' laboratories in comparative anatomy, embryology, histology, bacteriology, and pathology, and for the partial equipment of the chemical laboratory. The laboratories were furnished for a working class of twenty students in a section, and this sum of money covered the outlay for twenty Leitz microscopes with Abbé condensers, six students' microtomes, four

Thoma-Zeiss hæmocytometers, three Fleischl hæmometers; reagents and apparatus for making up students' outfits, including even such items as dissecting instruments, slides, and cover-glasses, drawing and note paper, drawing pencils; together with the equipment of a teacher's private laboratory for pathology and bacteriology. About fifteen hundred dollars more was spent for laboratory desks, plumbing, gas-fitting, remodeling of rooms, shelving, etc. Eighty students availed themselves of the opportunities afforded by these laboratories, and from these students eight hundred dollars was received for material consumed. This year we added seven hundred dollars' worth of additional material to our supply rooms, and our stock is now sufficient to supply classes of the present size for several years with but a small annual outlay for additional material. From my personal knowledge I know this is essentially the experience in the College of Physicians and Surgeons of Chicago, in which laboratories were fitted out on this plan four years ago, though on a much larger scale than in our institution. Like a well-conducted mercantile enterprise, a laboratory projected on business principles need not become a burden on the school adopting it. The student, as consumer, pays for the material consumed, leaving the standing investment in stationary laboratory furniture the only real outlay.

The methods of instruction in the laboratory will naturally vary according to the individual ideas of the teacher, and here, of course, no fixed rules can be laid down, though certain fundamental principles are established by pedagogic experience. Like the foreman in the workshop, the teacher of a practical laboratory course should be merely a guide or overseer. One of my friends, whose abilities as a laboratory teacher I highly esteem, compares the teacher to the magnet under the paper covered with iron filings, whose in-

fluence is felt and not seen. Many teachers do so much work for their classes that the students become mere hollow echoes instead of real living beings. Others attempt to instruct by holding chastising penalties over the awe-struck student, instead of winning his co-operation by exciting a natural interest in a subject. It is hard to resist driving dull or careless students, but after all a student who obtains his knowledge by having it stuffed down him becomes very like an overdistended sausage filled with all kinds of indigestible meats.

The material for a certain laboratory lesson should be provided, the task set, brief directions given, and the prosecution of details should be left with the individual student. Inflexible rules should not be laid down about the work of a student, but his individuality should rather be encouraged. It is often surprising to find how widely students differ in the routes by which they arrive at a common result—much like the originality shown by certain students in solving mathematical problems. Careful attention to technical details must, of course, be emphasized in some instances, for we all know how much often depends upon the care with which we follow the rules of our empirical laboratory technics.

Both for stimulating methodical habits of observation and for his future reference, the student should be required to produce careful laboratory notes and drawings. To encourage the powers of observation it is imperative that the student be supplied with laboratory manuals that contain only technical directions and suggest the lines of study without furnishing the notes and illustrations. Very few laboratory manuals in the market meet this demand in the subjects taught in medical schools, and it will usually be found preferable to supply the student with a mimeographic or typewritten syllabus containing directions for the exer-

cise in hand. I believe the ideal model for such laboratory exercises as have been indicated will be found in the laboratory directions which appear in that incomparable and epoch making little work by Huxley and Martin on *Practical Elementary Biology.*

Both for purposes of technical instruction and for meeting the logical indi·ation, a certain sequence ought to be observed in presenting the various laboratory studies. For students who have not had a previous biological laboratory training, practical study of a few simple types of animals and plants should introduce the laboratory work. Elementary vertebrate anatomy studied by the careful dissection of two or three types should follow, and later still the study of embryology. Elementary histology and elementary physiology also find their place in the first year's work, largely in connection with the foregoing branches. No student ought to be admitted to the study of practical human anatomy who has not completed the laboratory work in vertebrate anatomy, or its equivalent. Advanced physiology and histology come in the second year's course, along with bacteriology, which naturally precedes the study of practical pathology. Chemistry is, of course, included among the fundamental laboratory studies, though its exact position in the course is hard to fix.

Even with the best possible instruction in these various laboratory branches, which are usually completed in the first two years of the medical college course, the student's knowledge is gradually lost unless he can constantly apply it, and this suggests the necessity for laboratory facilities for third and fourth year students, in which they can, by the aid of the training previously received, apply their laboratory knowledge to clinical purposes. This means that a laboratory should be set aside for students pursuing clinical studies in which they can work up the material obtained

from the bedside, and thus make easy the next step in which, upon graduation, the student will purchase his microscope and simple laboratory equipment and apply his laboratory knowledge in his private practice. The evolution of the original investigator from such material as this will be a natural consequence.

The New York Medical Journal.

A WEEKLY REVIEW OF MEDICINE.

EDITED BY

FRANK P. FOSTER, M.D.

THE PHYSICIAN who would keep abreast with the advances in medical science must read a *live* weekly medical journal, in which scientific facts are presented in a clear manner; one for which the articles are written by men of learning, and by those who are good and accurate observers; a journal that is stripped of every feature irrelevant to medical science, and gives evidence of being carefully and conscientiously edited; one that bears upon every page the stamp of desire to elevate the standard of the profession of medicine. Such a journal fulfills its mission—that of educator—to the highest degree, for not only does it inform its readers of all that is new in theory and practice, but, by means of its correct editing, instructs them in the very important yet much-neglected art of expressing their thoughts and ideas in a clear and correct manner. Too much stress can not be laid upon this feature, so utterly ignored by the "average" medical periodical.

Without making invidious comparisons, it can be truthfully stated that no medical journal in this country occupies the place, in these particulars, that is held by THE NEW YORK MEDICAL JOURNAL. No other journal is edited with the care that is bestowed on this; none contains articles of such high scientific value, coming as they do from the pens of the brightest and most learned medical men of America. A glance at the list of contributors to any volume, or an examination of any issue of the JOURNAL, will attest the truth of these statements. It is a journal for the masses of the profession, for the country as well as for the city practitioner; it covers the entire range of medicine and surgery. A very important feature of the JOURNAL is the number and character of its illustrations, which are unequaled by those of any other journal in the world. They appear in frequent issues, whenever called for by the article which they accompany, and no expense is spared to make them of superior excellence.

Subscription price, $5.00 per annum. Volumes begin in January and July.

PUBLISHED BY

D. APPLETON & CO., 72 Fifth Avenue, New York.